DOCUMENT RESUME

ED 204 119 SE 035 171

AUTHOR Jacobson, Willard J.
TITLE A History of the Department of Science Education, Teachers College, Columbia University.
PUB DATE Apr 78
NOTE 44p.: Paper presented at the Annual Meeting of the National Science Teachers Association (26th, Washington, DC, April 7, 1978). Contains occasional light type.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *College Science: *Departments: *Doctoral Dissertations: Educational History: Higher Education: Science Education: *Science Education History
IDENTIFIERS *Columbia University NY Teachers College

ABSTRACT

This paper presents a summary of the history of the Department of Science Education at Teachers College, Columbia University along with a list of significant dates and occurrences within that department from 1892 to the present. It includes a list of doctorates and dissertation titles from 1921 to 1977. (CS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

A HISTORY OF THE DEPARTMENT OF SCIENCE EDUCATION, TEACHERS COLLEGE, COLUMBIA UNIVERSITY*

Willard J. Jacobson
Department of Science Education
Teachers College,
Columbia University

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
WILLARD J. JACOBSON
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED204119

The history of the Department of Science Education at Teachers College, Columbia University is intermeshed with the history of the institution of which it is a part. Teachers College evolved out of a concern for the plight of others, particularly the poor, and the conviction that education should be the subject of systematic study. The remarkable Grace Dodge and others turned their abilities and energies to improving the condition of the poor and downtrodden. Part of their work was through the Kitchen Garden Association which evolved into the Industrial Education Association, and this Association, under the leadership of Nicholas Murray Butler, organized and was absorbed by the New York College for the Training of Teachers. The New York College for Teachers became Teachers College in 1892.

During these same years, Columbia University had a president, Frederick A.P. Barnard, who was keenly interested in the study of education. Although rebuffed twice by the Trustees of Columbia College when he proposed that a chair or department of education be instituted, he succeeded in enticing a young student, Nicholas Murray Butler, into the study of education. After extensive readings and studies in Europe, Butler became the president of the Industrial Education Association. Under his leadership and with the aid of Frederick A.P. Barnard, the Industrial Education Association was transformed into the New York College for the Training of Teachers. There was fear on the part of some of those whose main interests were in allaying social ills that the philanthropic enterprises would be overshadowed by the academic interests and ideals. Throughout the ensuing years, such fears would be expressed again and again by those who felt most keenly about either the social missions or the academic ideals. Butler went on to become president of Columbia University. The New York College he headed became Teachers College. Although a college in Columbia University, with many symbiotic relationships with other schools and departments in the University, Teachers College has remained largely independent fiscally, has control over most of its academic programs, and has its own president.

Students in the early days of Teachers College had opportunities for the study of science. When the new building for the College was constructed, laboratory facilities were provided on the fourth floor. Walter L. Hervey, who succeeded Nicholas Murray Butler in the presidency, reported an interesting perspective on the role of science education.

---

*Paper presented as part of the session "Illuminating the Present from the Past: The History of Science Education" at the 26th National Convention of the National Science Teachers Association, April 7, 1978 in Washington, D.C.

SE 035 171

"Physical science and laboratory work generally are used as a schooling in common sense, in intellectual honesty and in faithfulness..." "In natural science the problem...being first, for a demonstration of the possibility of introducing apparatus and laboratory work at low cost, but later for a sharp distinction between superficial work, chiefly for extent (sic) of knowledge of science, and intensive work productive of good habits of mind and an acquaintance with scientific truth at first hand with empahsis upon the latter as the only defensible mode of scientific study. For the future the problem in science in the College will be a larger one and will include a study of the values and methods of teaching biologic science. This must be done by a specialist who, it is hoped, will be appointed in time to enter on his duties next year".[3]

The early work in science education was offered in such separate sections as biological sciences, physical sciences, geography and geological sciences, and nature study. Offerings apparently were much influenced by the need for instruction in the "Practical Arts". The first grouping of "Natural Sciences" occurred in 1921. For four decades it was known as the Department of Natural Sciences or Teaching of Natural Sciences. It became a Department of Science Education in 1962. It is to be hoped that some of the experiences in this department since its origins in the 1890's will illuminate the present and be of some value as we consider the future.

There are several ways that history can be written.[4] Historians can try to describe as accurately and wisely as they can events that have transpired, but they have to choose and select what to describe out of all that has transpired in the past. Also, many historians agree that history is written from different points of view so that quite different histories can be written of the same time periods and of the same events. History can also be written with current problems as a focus, and experiences of the past can be used to illuminate problems and broaden the range of our understandings. This approach is also useful in broadening the range of possible resolutions to problems. A common perversion of this approach is to emphasize what experience has shown cannot be done. Instead, it is usually more profitable to use this approach to broaden the range of what is possible. A third approach is to try to identify broad themes that seem to emerge from the study of movements, institutions or departments. Certainly, the themes that are developed are a function of the student of the past -- other students are quite likely to identify different themes. However, the themes can be helpful in interpreting the past and suggesting possibilities for the future. The thematic approach does have some usefulness in providing more background for planning of policies for the future.

In this paper the thematic approach to history is used. These themes are used in part to interpret events in the past, but a more important use is to identify possibilities for the future. Eight basic themes have been delineated. They are discussed with illustrations from the experiences of the Department of Science Education. Perhaps more importantly, possible implications of these themes for future policies

are suggested. Two of these themes are discussed in this paper. The themes that have been delineated are:

I Educational institutions and departments develop traditions and tend to be successful when study, teaching, research, and development are consistent with these traditions.

II The fortunes of a department of science education depend upon the status of science and science education in the broader society.

III Private teacher education institutions and their departments of science education survive and succeed, at least in part, by recognizing and dealing with needs that are not being met in public institutions. When public institutions move to meet these needs, private institutions, in order to survive and succeed, attempt to identify and meet new needs.

IV If a field of human endeavor is worth doing, it is worth studying so that we can learn how to do it better. If educating in science is worth doing, then departments of science education have a responsibility to study the processes of educating in science so that we can learn how to improve teaching and learning in science.

V Departments of science education can contribute to the development of the profession of science education.

VI The programs and contributions of a department of science education are enhanced if it devotes attention to problems and possibilities at various levels: local, state, national and international.

VII A department of science education can make important contributions by helping to develop relatively underdeveloped fields of education. One such field has been elementary school science.

VIII In science education research, especially in research undertaken in doctoral programs, it is healthy to have a mix of research problems. Some of the problems should be identified and deemed uniquely important by the individual researcher. Research on other problems is significant because it can contribute to a broader research effort.

Educational institutions and departments develop traditions and tend to be successful when study, teaching, research and development are consistent with these traditions. Traditions are customs and established ways of thinking that are generally accepted and handed down from generation to generation. For example, many universities have great traditions of academic freedom that are perhaps best expressed by the inscription on a wall at the University of Wisconsin, "Whatever may be the limitations which trammel inquiry elsewhere, we believe that the great state University of Wisconsin should ever encourage that continual and fearless sifting and winnowing by which alone truth can be found." If all members of a university community can accept this tradition then it is possible to move ahead on other matters without devoting time and energy each generation to the matter of academic freedom. Certainly, it is important to challenge some traditions, but, if certain traditions are generally accepted, then it is possible to devote our energies to other matters. It is suggested that there are traditions in science education on which we can base our studies, teaching, and research. When study, teaching research and development are consistent with these traditions, it is contended that we shall be more successful.

Fortunately, various departments of science education will have different traditions, but it is suggested that, if these traditions continue to be generally accepted, science educators will tend to be more successful if they recognize these traditions and work within these contexts. The students and faculty of the Department of Science Education at Teachers College, Columbia University have studied, taught and done research and development within two traditions. First, there is the tradition of concern for the improvement of the lot of mankind. This concern may have been for the problems of children, teachers, communities, or mankind in general. Second, there is the tradition of systematic study of problems in science education. This systematic study may have been of the practical problems that teachers and curriculum developers have faced, or questions and problems related to theoretical constructs in education and related sciences. Often, these traditions have been interrelated. Some of the problems that have been faced in the attempts to improve the lot of mankind have been subjected to systematic study, and it can be argued that the deep embroilment in some of the problems facing mankind has provided a fertile context for the systematic study of science education. Similarly, the results of systematic studies should result in the improvement of science education.

In the early years, many of the scientists and science educators at Teachers College were deeply engaged in the sciences related to various "practical arts." There were such courses as household chemistry, nutrition, nature study and the teaching of nature study, hygiene, and many courses contributing to the education of nurses and other health professions. One of the early science educators at Teachers College, Maurice A. Bigelow, served as Director of the School of Practical Arts. For a number of years, instruction in nutrition was actually in the Department of Science Education. Today, Teachers College has one of the largest graduate nursing education departments in the nation.

This concern for the "practical arts" stemmed from the philanthropic and social concerns of such prominent founders as Grace Dodge. This tradition has influenced instruction in the Department of Science Education. In the early years, some unique courses, such as "Household Physics" and "Textile Chemistry" and one of the first programs in nutrition education were developed by science educators at Teachers College and made available to future science teachers as well those preparing to become nursing educators, nutritionists, home economists or health educators. These courses and programs certainly made possible some rather unique educational programs for future science teachers. Teaching and assisting in these courses provide support for students in science education in much the same way that work in undergraduate science programs helps maintain graduate students at other universities.

There has been an explicit policy of developing educational programs that are best suited for each of the students involved in the programs, although there certainly have been differences of opinion among the students as to the extent that this policy has been achieved. In the early nature study courses, students were helped to make observations and carry out projects in the environment, whether city or rural, in which they lived and taught. Geology and earth science courses for teachers were developed as early as 1898, and special attention was given to the

study of physiographic features in the regions where the earth science would be taught. In two very important dissertations detailed descriptions were given of where distinctive geological features could be found in the New York City region and the Baltimore region.[5] Courses featuring the study of science in the environment in and near New York City have been offered. Field courses with a regional-community study emphasis have been given in such field centers as Lakeville, Connecticut; Plymouth, New Hampshire; and Gettysburg, Pennsylvania. In many of these courses, the practical problems of working with children in the field were considered along with the science content of environmental studies. Professionalized science content courses have been offered in fields ranging from "Physical Nature Study as Related to Life in Cities" to "Electron Microscopy" and "The Science of Acoustics" to "Coastal Oceanography," (It is interesting to note that a course in "Ecology" was given as early as 1904.) In these professionalized content courses, an attempt was made to choose science content that would give students a deeper understanding of the content that they would teach in elementary and secondary schools and to demonstrate exemplary methods of teaching that would be models for young teachers.

As in many graduate professional schools, students have been encouraged to relate their studies to the problems that they face in their institutions. It is reasoned that study and learning is more effective if it is related directly to problems that students have recognized. At its best, in this approach students are helped to generalize their learnings to other situations. Also, there has been the hope that this is an effective way to improve science teaching in the schools. A glance at the list of doctoral dissertations appended to this paper will indicate that a wider range of dissertation topics has been accepted for the doctorate than at some other institutions. In many studies, students have systematically investigated problems that they have identified in their professional work and then related their findings to the field. Within this tradition, some have argued that a dissertation should be more than a contribution to the field of science education -- it should also be a very significant contribution to the education of the doctoral researcher, and one of the most important elements of this education is the development of abilities to identify and systematically study problems that the researcher judges to be important.

Some of the research and development that has been sponsored by the Department has been within the tradition of concern for the improvement of the lot of mankind. The various projects in nutrition, in fact the development of the field of nutrition education, have had this general aim. There have been materials development projects related to such areas as electric power, aviation, and crustal evolution. The "New Sciences for Inner City Project" and the Center for Urban Education Teacher Education Project had as their aims the improvement of the science experiences of children in the inner city. The Population Education Project which is seen as a part of a broader Citizens and Science Education Study have as their aim the improvement of young people's abilities to comprehend and analyze critical problems that have scientific and technological dimensions.

The study and work in science education in nations throughout the world is one of the most significant efforts within the tradition of concern for the lot of mankind. For 23 years Teachers College had a

team in Afghanistan and for most of those years there was a science educator from the Department of Science Education working with our science education colleagues in Afghanistan. Representatives of the Department have also studied and worked in two Teachers College projects in East Africa, Nigeria, Egypt, Guatemala, Brazil, India, United Kingdom, Germany and Canada. Even more important have been the contributions of the students from countries around the world who have come to study science education with other students and faculty in the Department of Science Education. Nations such as Egypt and Nigeria have sent some of their ablest science educators, and they have heightened the concern for the lot of mankind and contributed at least as much as they have received.

The second tradition within which the students and faculty of the Department of Science Education have worked is that of subjecting the problems of science education to systematic study. Science education research has been defined as "...the systematic attempt to define and investigate problems involved in learning and instruction in science."[6] Both practical problems that have arisen in science teaching and more theoretical problems linked to theories in psychology and other social sciences have been studied. This is a tradition of long standing at Teachers College, and the Department of Science Education has made important contributions to the field of science education and given leadership in research within Teachers College. It is noteworthy that, when the College sought leadership for its Department of Practical Arts, it turned to a scientist, Maurice A. Bigelow. When it sought leadership for its newly-formed Institute of School Experimentation, it again turned in the direction of science and selected Otis Caldwell.

Throughout the history of the Department of Science Education, a wide variety of science education research and development projects have been undertaken. Only a few can be briefly described that are typical of certain approaches to research and that have had considerable influence on the field.

In the early Twentieth Century, the primary influence upon science courses and programs was the nature of the science taught. One of the first studies in which a broader approach was used in developing a course of study was Gerald S. Craig's "Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann School." In addition to examining authoritative source books of science, Craig systematically developed a list of objectives for science instruction in the elementary school. The objectives were evaluated on the basis of educated laymen's judgment of needs, children's questions in science, and the meanings developed in authoritative source books of science. The curriculum development methods have been expanded and refined, but they opened the door to a much more comprehensive approach to science curriculum development. The elementary science program that was developed influenced the nature of elementary science programs for the next thirty years.

Especially during the thirties, there was great interest in the study of the science interests of children. Several such studies were carried out within the Department of Science Education. Not only were children and adolescents asked what they were interested in, but ingenious ways were devised to ascertain their interests when in museums, out in the en-

vironment, and when given a variety of science source materials. The results of these studies were used to build science courses and programs and to plan science books and other materials. The factors that influence the responses of pupils in studies of scientific interests was studied by Frederick L. Fitzpatrick.[8] Fitzpatrick had fifth, seventh, eighth, tenth grade students, and graduate students react to science terms stated in four different ways at intervals of 15 minutes and again after a period of three months. He found that the interests tended to be transitory and that the average individual changed his or her testimony to a marked degree after a three months' interval. He concluded that, "the general inconsistency of the testimony makes any conclusion regarding the groups of subject-matter materials upon the basis of 'interests' of dubious value."[9] The results of this study were not interpreted to mean that interests were not important, but, because of their transitory nature, they should not be the sole or primary basis on which to plan science programs. The results of the study were also interpreted to mean that motivation was important and that teachers could interest students in subjects in which they might initially show very little interest. This study of interests is an example of a systematic investigation that was rooted in current practice and served to re-direct teaching, science curriculum development, and the development of books and other science materials.

The Bureau of Educational Research in Science was established in 1935, and it had as its primary goal the education of young people in accordance with their needs.[10] It should be remembered that this was in a time of economic depression, great interest in progressive education, and when the eight year study was carried out to try to break the restrictions imposed by the great concern for college preparation. Scholars in various fields were assembled to determine what scientific knowledge was needed by young people to understand and deal with the problems they face, and they produced six books as well as advising the teachers and curriculum developers in the project. Then, a series of teaching suggestions was prepared by expert classroom teachers on how the materials prepared by the Bureau could be used with young people, and three monographs and many journal articles were prepared. In the third interval, the Bureau worked with seventeen school systems from all regions of the United States to help develop science programs that would better meet the needs of young people. The research and development work of the Bureau of Educational Research in Science contributed to a broader effort to redirect the education of youth. In this effort it drew upon scientists, science educators, classroom teachers and scholars from various social sciences.

By 1953 it had become clear to science educators who study these matters that there would be an insufficient number of scientists and engineers to meet the needs of the national economy and that many of our elementary and secondary school science programs were sadly deficient. A Science Manpower Project was initiated in 1954 with support from 37 industrial firms and foundations.[11] A number (33) of science education fellows were recruited to do the research and development work. The Project was advised by a Joint Industry-Education Advisory Council, a

Corresponding Advisory Board, and by sixty Associates of the Project who worked in other teacher education institutions. A policy statement and a wide variety of curriculum and instructional materials were produced. Several science education research studies were carried out, notably the studies of Attitudes of High School Seniors Toward Science and Scientific Careers.[12] The Science Manpower Project was a research and development project designed to meet societal needs, and the originators of the Project identified this need somewhat earlier than many others.

All fields have a problem of making the results of research available to other researchers and practitioners. In science education, the pioneering work in processing science education research was done by Francis D. Curtis who published three volumes of digests of investigations in the teaching of science. Since the Department of Science Education was concerned with the utilization of research in the field, steps were taken to reprint the "Curtis Digests", and Robert W. Boenig, J. Nathan Swift, and Elizabeth Phelan Lawlor extended these reviews through 1957.[13] These Reviews of Research in Science Education were viewed as contributions to the development of the field of science education. This work is now being carried out by the National Association for Research in Science Teaching and the ERIC Science, Mathematics, and Environmental Education Information Analysis Center.

Teaching is largely a matter of communication, and much of this communication is verbal. A theory of structure in teaching within the broader evolutionary theories and theories of communication has been developed by O. Roger Anderson[14], and this theory has provided a theoretical framework for a series of studies by Anderson and his students. The nature of structure in verbal communication, differences in the structure of the verbal discourse of teachers, and the possible differences in structure in different fields have been studied. The effect of varying structure upon learning by different kinds of students has also been studied. These are examples of empirical studies that are carried out within a theoretical framework and whose results contribute to the further development of the theory.

For traditions to be generally acceptable they have to be general in nature. They become more specific as they are operationally defined in practice, and then there may be sharp disagreements. While there seems to have been general agreement with the tradition that to improve the lot of mankind is "a good thing to do" and "we should be trying to do it", there have been sharp disagreements over the best ways to do it. There have been sharp disagreements over the development of science courses that deal specifically with problems in the "practical arts" that are faced by practitioners. Some have argued, "We are not helping (perhaps harming) teachers (nurses, nutritionists, home economists, technicians) by developing courses that deal with the specific problems in their professions. They should have the same basic chemistry (biology, physics, bacteriology, physiology) that everybody else gets." Also, there seems to have been general agreement that systematic investigation is "a good thing to do." Again, there have been sharp disagreements when this tradition is operationally defined. For example, some have argued, "all research should be theory-based and problems should be selected that will help fill gaps and extend the theory. To study a problem faced by teacher 'y' in school 'x' is not the best way to do that." But, these arguments have taken

place a step or two above the base of the ladder. The general acceptance of the two traditions has made it unnecessary for each generation of students and faculty to return to "ground zero" to argue the traditions before proceeding to other matters.

The fortunes of a department of science education depend upon the status of science and science education and other developments in the broader society. The Department of Science Education and the field of science education has been affected by developments in the sciences, changes in the population served by the schools and teacher education institutions, developments in psychology and other foundational social sciences, and by fluctuations in the status of science and science education in the broader society. Many examples of the effects of profound changes in the broader society can be found in the changing fortunes of the Department of Science Education, its parent institution, and the general field of science education.

Developments in the sciences have led to changes in science programs and in the offerings of teacher education institutions. In the first three-quarters of the Twentieth Century there were tremendous developments in the physical sciences, the opening up of new fields of science, great activity in explorations at the boundaries between established sciences, the development of new tools for scientific investigation, the discovery of how to release energy locked in the nucleus of the atom, and greatly intensified explorations of space. As the number of discrete sciences that might have claim to a place in science programs has proliferated and broader scientific generalizations have been defined, there have been attempts to view science as unified science. Many science educators, as they have viewed the tremendous scope of activities in the sciences, have seen programmatic advantages in such a view of science.

Certainly, one of the factors contributing to the emergence of elementary school science has been the developments in the physical sciences and the further development of other areas of science that many thought that children should consider. At Teachers College in 1902 there were courses in "Biological Nature Study" and "Physical Nature Study as Related to Life in Cities." In such courses and in the teaching in elementary schools, there was little attention to electricity, sound, light, machines, chemical change and other areas often found in modern elementary science programs. Little work had been done to identify major concepts in science, and the delineation of science processes and the development of science experiences to gain these process skills was to come later. The first course that might be considered an elementary science course to appear in the Teachers College Bulletin was "Science in the Experience and Environment of the Child" taught by Morris Meister.[15] In 1923-24, there was a course "Science for the Elementary Grades" taught by E. Laurence Palmer.[16] In 1927-28, Gerald S. Craig taught an elementary science course for teachers at Teachers College for the first time, and some students of the history of elementary school science regard the publication of his Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann Elementary School as marking the advent of modern elementary school science. The range of elementary school science was broadened to include new material from the sciences in the Science Manpower Project monograph Modern Elementary School

Science.[17] Members of the Department of Science Education, through their participation in the AAAS Science -- A Process Approach and the Science Curriculum Improvement Study, have helped to further refine science concepts to be developed in elementary school science and to develop programmatic materials for the development of science process skills.

The science education program at Teachers College has reflected the opening up of new fields of science, activity at the boundaries between established sciences, and the development of new instruments for scientific investigation. In the work in the Department of Practical Arts, early courses in biochemistry, microbiology, neurophysiology were offered. In part because of the growing importance of oceanography, the Department has offered for many years courses in oceanography and coastel oceanography. For several years it offered "Physics and Astronomy in the 20th Century." Now, it joins most other institutions which, although the United States is a leading nation in space exploration, chooses to ignore astronomy and the space sciences. To give future science teachers an acquaintance with an important tool in the biological sciences, students have available to them a course in Electron Microscopy.

In science, the philosophy of science, and science education there has been considerable interest in unified science. While many colleges and universities had separate departments of botany and zoology, chemistry and physics, even in 1896 Teachers College was offering courses in the biological science and physical science. The first course on the Teaching of General Science was offered in 1919. The work in many related sciences was unified in Earth Science. However, although there has been considerable movement toward unified science at various times throughout the nation, there has been little attention given to this in the Department of Science Education.

Science in the schools and in teacher education institutions has been greatly affected by changes in the populations served. In the early Twentieth Century, the American high school became a school for all American youth. American education struggled to adjust to this change for decades, and it may not yet have succeeded in making the adjustment. The research and development work of the Bureau of Educational Research in Science was largely devoted to developing science programs that would meet the needs of this broader population. Particularly in the period following the Great Depression, large numbers of Americans moved from rural areas into the cities. The New Science for Inner City Project was one attempt to develop science programs for children in cities. At various times, the Department has offered courses specially designed to relate to teaching science in the cities. And the nature of the student body at Teachers College also changed. In the summer session of 1958, 1521 students came to Teachers College from states in the South.[18] This was about 29 per cent of the student body. With the opening up of more southern universities to Black students, fewer came to institutions such as Teachers College. In the summer session of 1967, only 311 students from southern states attended Teachers College. When there is almost a 500 per cent decline in enrollment from a region, it has an impact upon all programs including science education. This profound societal change had great impact upon many institutions both North and South.

Developments in psychology and other foundational social sciences have had important influences upon science education and the Department. The psychological studies, many of which were carried out at Teachers College, that led to general rejection of formal transfer theory had widespread implications. No longer could courses that had always been in the curriculum be justified because they were effective in "mental training." The education had to be more closely related to the specific abilities that were to be developed. The committee, chaired by S. Ralph Powers, that wrote the 31st yearbook, A Program for Teaching Science[19] had as one of its major goals the development of science programs that were more consistent with the newer psychology. The behavioristic psychology which has been the foundation for competency based education has been very influential in education. In the Department of Science Education, Gary C. Bates developed a competency based pre-service teacher education program. Piagetian psychology has found particularly fertile ground in science education. The Science Curriculum Improvement Study was deeply grounded in Piagetian psychology and the elementary science work in the Department has been greatly influenced by this psychology.

At times in the past, science education has been viewed as a way the society and its children and young people can meet their problems. This optimistic view was evident during the years of the economic depression and was expressed in the activities of the Progressive Education Association. Students and faculty members of the Department of Science Education contributed to the development, writing and testing of Science in General Education.[20] In this book, a wide variety of suggestions was made to make science education more consonant with the needs of young people. Some of the recommendations in the book anticipated the interest and activities in conservation, environmental science, and consumerism in the Seventies. The work of the Bureau of Educational Research in Science was in the same direction as the Committee of the Progressive Education Association. In the Department of Natural Sciences this was a very active period, and its students and faculty joined in the effort to contribute to the solution of very serious problems.

Similarly in the Fifties and Sixties, science education was seen as a way of dealing with societal problems. Actually, the incipient shortage of scientists and engineers had been forecast in the early Fifties by members of the Department, and the Science Manpower Project was organized. In organization, with its emphasis on the development of policy statements and teaching materials and its links with cooperating institutions, it resembled the Bureau of Education Research in Science. It was funded by a large number of foundations and industrial firms. While this forced the staff members to devote a great deal of energy to securing support, it also established important ties with these foundations and companies. The Science Manpower Project was designed to meet some of the societal needs that had been identified. Some of the contributions of the Science Manpower Project have been obscured because in 1957 the Russians sent Sputnik I into orbit, the nation organized a major effort in science education, and other organizations and institutions received support on a much grander scale.

Throughout these periods, perhaps the greatest contributions of the Department of Science Education has been the students who have worked and studied there. An examination of the list of doctorates (See appendix III,)

will indicate that many leaders in science education have had part of their education in the Department of Science Education. Many teachers and science educators were involved in the Bureau of Educational Research in Science and in the Science Manpower Project. Although seldom made explicit during the planning stages, it may be that the most important contribution of these and other projects was the education of those who participated. If the past is to illuminate the present and the future, it might be desirable to plan research and development projects with this as one of the primary goals. Among his reflections upon the Rand study of educational change, Dale Mann has arrived at a similar conclusion, "Federal efforts to improve local schools have been hampered by a paradox. Change is whatever the service deliverers -- schools and teachers -- decide it is to be. The less self-determination is allowed to these ultimate implementors of change, the less total change will result."[22] Others have said "innovation stops at the schoolroom door." Perhaps, the involvement and education of a larger number of teachers should be seen as a major goal in research and development work.

The Fifties and the Sixties were a period of unprecedented activity in science education.[23] A great deal of money, primarily from Federal sources, was devoted to curriculum development. The number of scientists and engineers was increased, and the nation succeeded in reaching its goal of placing a man on the moon. New programs were developed in science and mathematics for the elementary school and for each of the science and mathematics subjects usually taught in the secondary schools. Members of the Department of Science Education participated in several of these programs. It sponsored a trial center for the Science Curriculum Improvement Study and several institutes for teachers and supervisors in elementary schools, secondary schools, and teacher education institutions. During the latter part of this period, the Department had its largest faculty and relatively large student enrollments that were surpassed only in the period after World War II when there were many returning veterans.

After this unprecedented activity in the Fifties and Sixties, scientists and science educators could not help but express disappointment at the decline in the status of science and science education in the public eye. Various forms of anti-science have flourished along with other forms of anti-intellectualism. There has been a tendency on the part of the press and members of the public to view science as a source of evil rather than as a source of possible good. Enrollments in some of the science courses in schools and colleges have declined, and there has probably been a decline in the teaching of elementary school science. The decline in the enrollments in the Department of Science Education reflect similar declines in many other institutions. This rise and fall in favor of science and science education amongst its publics in the broader society shows how the fortunes of science and science education depend upon developments in the broader society. It would appear that those who are committed to science education have much to do in educating in science and science education.

FOOTNOTES

1. I am indebted to my colleagues and students in the Department of Science Education for their critical and constructive comments.

2. The most comprehensive history of Teachers College is Lawrence A. Cremin, David A. Shannon and Mary Evelyn Townsend, A History of Teachers College Columbia University. New York: Columbia University Press, 1954.

3. Walter L. Hervey, Report of the President 1895-1896. Teachers College, New York City, pp. 8-9.

4. I am indebted to my mentors in historical method, R. Freeman Butts and Erling Hunt, for any insights I may have into historical method. I will understand completely if they wish to disclaim any responsibility.

5. Herbert J. Arnold, The Selection, Organization, and Evaluation of Localities Available for Unspecialized Field Work in Earth Science in the New York City Region. 1936.

   John R. Bareham, Earth Science in the Baltimore Area -- Opportunities for Field Work in Geomorphology. 1958.

6. Willard J. Jacobson in the Preface of each of the six volumes of the Reviews of Research in Science Education Series. This definition was used in the development of these reviews and in guiding science education research in the Department. Reviews of Research in Science Education. New York: Teachers College Press, 1971.

7. Gerald S. Craig, Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann Elementary School, Contributions to Education, No. 276. New York: Teachers College Press, 1927, 73 pp.

8. Frederick L. Fitzpatrick, "Pupil Testimony Concerning Their Scientific Interests," Third Digest of Investigations in the Teaching of Science. New York: Teachers College Press, 1971. pp. 238-243.

9. Ibid. p. 243.

10. The work of the Bureau of Educational Research in Science is summarized in Anita D. Laton and S. Ralph Powers, New Directions in Science Teaching. New York: McGraw-Hill Book Co., 1949.

11. A description of the Science Manpower Project, how it was organized and a list of its publications is to be found in Frederick L. Fitzpatrick and Willard J. Jacobson, "The Science Manpower Project: Its History and Its Program," Science Education. Vol. 52, No. 3 (April, 1968), pp. 256-269.

12. Hugh Allen, Jr., Attitudes of Certain High School Seniors Toward Science and Scientiric Careers and The High School Seniors: Two Years Later. New York: Teachers College Press, 1959 and 1961.

13. Reviews of Research in Science Education. (6 Vol.) New York: Teachers College Press, 1971.

14. The theory and how it can be used to analyze classroom discourse have been described in two books by O. Roger Anderson, Structure in Teaching: Theory and Analysis. New York: Teachers College Press, 1969. Quantitative Analysis of Structure in Teaching. New York: Teachers College Press, 1971.

15. Morris Meister had many "firsts": first doctorate in science education from Teachers College, founder and first principal of the Bronx High School of Science, first president of the Bronx Community College of the City University of New York, and the first director of the Hall of Science of the City of New York.

16. Later, E. Laurence Palmer became one of the strongest advocates of nature study from his position at Cornell University, and there were lively debates between Palmer and faculty members in the Department of Science Education at professional meetings and in the literature.

17. Willard J. Jacobson and Harold E. Tannenbaum. Modern Elementary School Science. New York: Teachers College Press, 1961.

18. The enrollment statistics are from "Analysis of Summer Term Enrollment" prepared by the Registrar's Office of Teachers College.

19. S. Ralph Powers (ch.), A Program for Teaching Science, Thirty-First Yearbook of the National Society for the Study of Education, Part I, Chicago, Ill.: The University of Chicago Press, 1932.

20. Progressive Education Association, Science in General Education. New York: Appleton-Century-Crofts, 1938.

21. Frederick L. Fitzpatrick (ed.) Policies for Science Education. New York: Teachers College Press, 1960.

22. Dale Mann, "The User-Driven System and a Modest Proposal," Teachers College Record. Vol. 79, No. 3 (February 1978) p. 389.

23. For a review of science education research and development programs during this period in the United States see Willard J. Jacobson "U.S.A.: Post-Sputnik Science Curricula" in R. Murray Thomas, Lester B. Sands and Dale L. Brubaker (eds.) Strategies for Curriculum Change: Cases from 13 Nations. Scranton, Penn.: International Textbook Co., 1968. pp. 116-135.

Appendix I

A Chronological History

THE DEPARTMENT OF SCIENCE EDUCATION
Teachers College, Columbia University

1892 The New York College for Teachers Becomes Teachers College

1894 New buildings opened. "The Teachers College laboratories of chemistry and physics are large, specially equipped for the purpose of illustrating secondary teaching, and are daily used by the classes of the Horace Mann School." The biological laboratory was equipped with microscopes, microtome, paraffin-oven, a small conservatory for growing plants, several aquaria, a good set of preparations and skeletons, a set of folios by Audubon, and a collection of lantern slides "that is rapidly increasing."

1896 There is instruction in physical sciences, biological sciences, and geography-geology.

1898 First extension course. A course in Nature Study given on Saturdays.

1899 There are courses in "Biological Nature Study", "Methods of Teaching Geography and Geology in Secondary Schools" "Methods of Teaching Geography in Elementary Schools", and "The Teaching of Physical Science in Secondary Schools".

1902 Bachelor's Diploma offered in Biological Sciences and Physical Sciences. Master's apparently only offered in Botany and Zoology.

1905 A section or department of Nature Study

1906 "Practicum in Teaching Biological Sciences in Secondary and Normal Schools" is offered.

1907 A course, "Nature Study for Primary Schools," is added.

1910 The first appearance of a course entitled "The Teaching of Elementary Science -- Including Agricultural, Biological, and Physical Nature-Study; Elementary Geography; and Introductory Science.

1912 A School of Practical Arts with "full University Grade " with a scientist, Maurice A. Bigelow as director. Programs include applied biology, applied physics, organic and household chemistry, biological chemistry, nutrition and food economics, and hygiene.

1912 A School of Education established with biology, chemistry, hygiene and physics

1912 First mention of a grouping of major subjects under the title "Science Education."

1912 First listing of "The Teaching of Nature Study and Arithmetic in Elementary Schools" under elementary education

1913 Courses in "Human Biology" and "Biology in Sex Education" added

1919 First offering of a course on the Teaching of General Science

1920 A course entitled "Science in the Experience and Environment of the Child" was introduced.

1921 The first doctorate in science education awarded. The recipient was Morris Meister.

1921 The first grouping of courses under "Natural Science." Included separate courses in the teaching of biological sciences, botany, physics, and chemistry

1922 The first of several courses dealing with "Regional Studies in Science."

1923 The first mention of a course "Science for the Elementary Grades." Taught by E. Laurence Palmer.

1925 "Seminar: Natural Science Education" A seminar for candidates for the doctor's degree conducted by Otis Caldwell and S. Ralph Powers.

1927 A course, "Organization of Science for Elementary Schools" is introduced and taught by Gerald S. Craig. Gerald Craig publishes his study "Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann Elementary School."

1931 "Field Studies in Physical Sciences"

1932 "Social Science and Physical Science in Nursery School, Kindergarten, and Primary Grades."

1933 The Thirty-First Yearbook of the National Society for the Study of Education, A Program for Teaching Science, is published under the Chairmanship of S. Ralph Powers with major contributions in elementary school science by Gerald S. Craig.

1934 First separate course in the geological sciences taught by Herbert Arnold.

"Science Experiences with Inexpensive Equipment" offered by Carleton J. Lynde.

Doctor of Education program inaugurated.

Bureau of Research in Science Teaching organized with S. Ralph Powers as director.

1936 First offering of "Science and Society."

1938 The Department of Teaching of Natural Sciences inaugurated with S. Ralph Powers as Head of Department.

"The Work of the Consultant in Science"

1946 A two semester course "Science and Community Resources" organized and offered by Hubert M. Evans.

1947 The Forty-Sixth Yearbook of the National Society for the Study of Education, Science Education in American Schools, with contributions from Otis Caldwell and Gerald Craig.

1952 Frederick L. Fitzpatrick becomes Head of the Department of Teaching of Natural Sciences.

Special area seminars for Elementary, junior high school, biology, physical science, and junior colleges are organized.

Planning for the Science Manpower Project begins

1954 Department title changed to "Teaching of Science."

1956 First offering of a course "The History of Science and Science Education in Schools and Colleges" given by Hubert M. Evans.

Science Manpower Project begins with Frederick L. Fitzpaterick as director

Nutrition Education Research Project begins with Willard J. Jacobson as director.

1957 Chemistry offerings transferred to the Department of Teaching of Science

First offering of the Course "Science, Technology and Education" by Hubert M. Evans.

1961 First offering of two semester course in "Earth Science" organized and taught by Philip Bacon.

1962 The Department title is changed to the Department of Science Education

1964 Willard J. Jacobson becomes chairman of the Department of Science Education

1965 A trial center for the Science Curriculum Improvement Study is set up with Mary Budd Rowe as coordinator.

Inservice teacher education for the Science Curriculum Improvement Study is located in the Department with Willard J. Jacobson as director.

1966 The Center for Urban Education cooperative project with New York University, Hunter College and Teachers College for the preparation of elementary school science consultants and teachers in science. Warren Yasso and Daniel J. Brovey author the earth science materials.

1969 The editorial offices of the Journal of Research in Science Teaching move to the Department of Science Education with James Robinson as editor.

1970 O. Roger Anderson becomes editor of the Journal of Research in Science Teaching with the editorial offices remaining in the Department

The six volume Reviews of Research in Science Education published by the Teachers College Press; Willard J. Jacobson, Series Editor.

1970 "Study of Physics Teaching Project"; George Ivany as director.

1971 "Out of School Science Program for Junior High School Students of New York City" is inaugurated in cooperation with Joan of Arc Junior High School and New York University Medical Center with Frances L. Behnke as director.

Population Education Project begins with Willard J. Jacobson as co-director.

"New Sciences for Inner City Project", Mary Budd Rowe, director

1973 "Effects of Structure in Science Curricula on Learning by Mentally Retarded and Normal Subjects," O. Roger Anderson, director

1974 J.W. George Ivany becomes chairman of the Department of Science Education

1975 O. Roger Anderson becomes chairman of the Department of Science Education

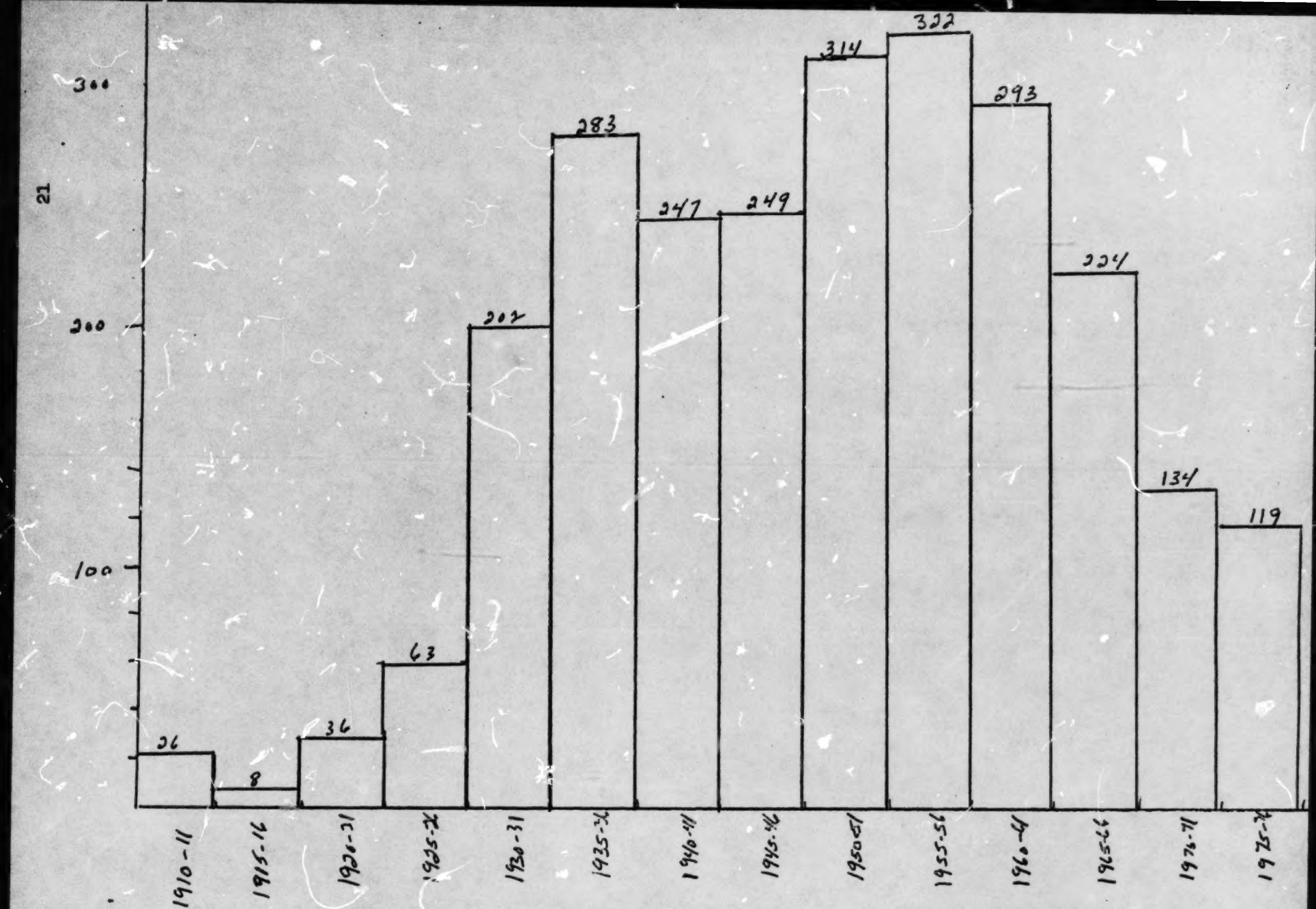
1976 "Crustal Evolution Education Project," Warren E. Yasso, Development Center Director.

FACULTY MEMBERS

DEPARTMENT OF SCIENCE EDUCATION

Date First Appointed		Field
1896	Lloyd, Francis E.	Biological Science
1896	Woodhull, John Francis	Physical Science (also Professor in charge of Buildings and Grounds)
1903	Bigelow, Maurice Alpheus	Biology and Director of School of Practical Arts
1908	Sherman, Henry Clapp	Chemistry of Nutrition
1909	Gies, William John	Biological Chemistry
1909	Vulte, Hermann T.	Household Chemistry
1914	Broadhurst, Jean	Biology
1914	Carpenter, Clifford D.	Chemistry
1917	Caldwell, Otis William	Education and Director of Lincoln School
1920	Eddy, Walter H.	Physiological Chemistry
1922	Heft, Hattie L.	Physiological Chemistry
1923	Palmer, E. Laurence	Natural Sciences
1924	Powers, Samuel R.	Natural Sciences
1927	Lynch, Carleton J.	Physics
1930	Craig, Gerald S.	Natural Sciences
1931	Fitzpatrick, Frederick Linder	Natural Sciences
1936	Arnold, Herbert J.	Natural Sciences
1947	Evans, Hubert M.	Natural Sciences
1952	Jacobson, Willard J.	Natural Sciences
1954	Pye, Orrea E.	Nutrition
1954	Renner, George	Geography
1954	Taylor, Clara	Nutrition

1957	Morse, Edna C.	Natural Sciences
1964	Anderson, O. Roger	Natural Sciences
1965	Gratz, Pauline	Natural Sciences
1965	Rowe, Mary Budd	Natural Sciences
1966	Williams, Eleanor Ruth	Nutrition
1966	Erickson, Jay William	Natural Sciences
1966	Yasso, Warren E.	Natural Sciences
1967	Ivany, J.W. George	Natural Sciences
1967	Robinson, James T.	Natural Sciences
1970	Lockwood, Linda G.	Natural Sciences
1975	Bates, Gary C.	Science Education



22 Enrollments Department of Science Education at Five Year Intervals

DEPARTMENT OF SCIENCE EDUCATION
Teachers College
Columbia University
New York, New York 10027

1921

Meister, Morris. The educational value of certain after-school materials and activities in science.*

1924

Curtis, Francis Day. Some values derived from extensive reading of general science.
(Contribution to Education No. 163).*

1926

Carpenter, Weston William. Certain phases of the administration of high school chemistry.
(Contribution to Education No. 191).*

Reeder, Edwin H. A method of directing children's study of geography.
(Contribution to Education 192).*

Twiss, George R. Science education in China; a survey of the present status and a program for progressive improvement. Published under the auspices of the Chinese national association for the advancement of education, Peking, China. Shanghai, China, Commercial press, 1925. 361 P.*

1927

Craig, Gerald S. Certain techniques used in developing a course of study in science for the Horace Mann Elementary School.
(Contribution to Education No. 276).*

1928

Ho, Ching-Ju. Personnel Studies of Scientists in the United States.
(Contribution to Education No. 298).*

Horton, Ralph Ellison. Measurable outcomes of individual Laboratory work in high school chemistry. (Contribution to Education No. 303).*

Van de Voort, Alice Maria. The teaching of science in normal schools and teachers colleges. (Contribution to Education No. 287).*

1929

Chappelear, Claude Simpson. Health subject matter in natural sciences.
(Contribution to Education No. 341).*

Laton, Anita Duncan. The psychology of learning applied to health education through biology; an experimental application of psychology in the junior high school. (Contribution to Education No. 344).*

---

*Signifies Ph.D. Dissertation.
**College Teaching of an Academic Subject
Omission of (*) indicates Ed.D. dissertation

1930

Baird, Don Otto. A study of biology notebook work in New York State. (Contribution to Education No. 400).*

Billig, Florence Grace. A technique for developing content for a professional course in science for teachers in elementary schools. (Contribution to Education 397).*

1930

Meir, Lois. Natural science education in the German Elementary Schools. (Contribution to Education No. 445).*

1931

Allander, Holger Fredrik. Science education in the secondary schools of Sweden; a comparative study of Sweden and the United States. (Contribution to Education No. 463).*

1932

Heiss, Elwood David. An investigation of content and mastery of high school general science courses.*

Nelson, George Edward. The introductory biological sciences in the traditional liberal arts college. (Contribution to Education No. 501).*

1933

Clemensen, Mrs. Jessie Williams. Study outlines in physics; construction and experimental evaluation. (Contribution to Education No. 553).*

Lackey, Earl Emmet. A method of selecting and evaluation materials for a course in introductory geography for teachers' college students (with emphasis on the home region) for a professional subject-matter treatment. 125 p.*

Knox, Warren W. A study of some of the influences of regents examinations in chemistry. 71 p.*

1935

Haupt, George Webster. An experimental application of a philosophy of science teaching in an elementary school. (Contribution to Education No. 663).*

Pruitt, Clarence H. An analysis evaluation and synthesis of subject-matter concepts and generalizations in chemistry.*

1936

Arnold, Herbert J. The selection, organization, and evaluation of localities available for unspecialized field work in earth science in the New York City region.

Atkins, Wesley Converse. Some probable outcomes of partial self-direction in tenth grade biology.*

1937

Adil, Avees. Recommendations and proposals for a science program for the first nine grades based on the individual and social needs of the people of Iraq. 147 p.

Efron, Alexander. The teaching of physical sciences in the secondary schools of the United States, France, and Soviet Russia. (Contribution to Education No. 725).*

Genmill, Mrs. Anna Murphy. An experimental study at New York State Teachers College at Buffalo to determine a science program for the education of elementary classroom teachers. (Contribution to Education No. 715.)*

Gillson, Mrs. Margary Stewart. Developing a high school chemistry course adapted to the differentiated needs of boys and girls. (Contribution to Education No. 709).*

1938

Brown, H. Emmett. The development of a course in the physical sciences for the senior high school of the Lincoln School of Teachers College.

West, Joe Young. A technique for appraising certain observable behavior of children in science in elementary schools. (Contribution to Education No. 728).*

1939

Bingham, Nelson E. Teaching nutrition in biology classes; an experimental investigation of high school biology pupils in their study of the relation of food to physical wellbeing. (Contribution to Education No. 772).*

Fraser, James Anderson. Outcomes of study excursion; a descriptive study. (Contribution to Education No. 778).*

1940

Bond, Austin D. An experiment in the teaching of genetics with special reference to the objectives of general education. (Contribution to Education No. 797).*

Burnett, R. Will. The opinion of science teachers on some socially significant issues.*

Cunningham, Harry Allen. Material Facilities needed in the training of intermediate grade teachers in science. (Contribution to Education No. 812).*

Williams, Alice Marietta. Children's choices in science books; a study to discover some elements of a book in the field of science that appeal to children. (Child development monograph No. 27).*

Zim, Herbert Spencer. Science interests and activities of adolescents.*

1941

Bush, George L. Science education in consumer buying.

Kilgore, William A. Identification of ability to apply principles of physics. (Contribution to Education No. 840)*

Underhill, Orra Ervin. The origins and development of elementary-school science.*

Waters, Eugene A. A study of the application of an educational theory to science instruction. (Contribution to Education No. 864).*

1942

Brewer, Waldo L. Factors affecting student achievement and change in a physical science survey course. (Contribution to Education No. 868).*

Meder, Elsa Marie. Youth considers the heavens; high school students' opinions about man's place in the world in relation to their astronomical information. 60 p.*

Pitluga, George E. Science excursions into the community; a handbook for teachers of grades four through eight.

Raskin, Abraham. Biology and general science textbook material on the effects of alcohol.*

Stickler, M. Hugh. Suggestions for teaching general science in the schools of the Panama Canal Zone.

1943

Decker, Donald Gilmore. The relationship between natural resources and activities of people in Colorado.*

Everote, Warren. Agricultural science to serve youth; outcomes of a course in experimental science for secondary-school students. (Contribution to Education No. 901).*

Howard, Frederick Thomas. Complexity of mental processes in science testing. (Contribution to Education No. 879).*

Loud, Oliver S. Suggestions for teaching selected material from the area of the interrelations of living things and their environment with particular attention to problems of good land use.

Panth, Dhola D. Consider the calendar.

Urban, John. Behavior changes resulting from a study of communicable diseases; an evaluation of the effects of learning on certain actions of high school pupils. (Contribution to education No. 896).*

Wezmar, John. A chemistry teaching unit for consumer education in the high school.

1943

Williams, Harry H. Pre-flight meteorology for high schools.

1944

Wright, Jay T. Public planning source book.

1945

Arey, Charles. Elementary school science for the air age, a teachers' guide.

1946

Blair, John Clyde. Some relationships of public expenditures in Alabama.

Evans, Hubert M. Science education and the study of community problems.

Hill, Katherine E. Children's contributions in science discussions in an elementary school considered in relation to certain objectives for science instruction. (Contribution to Education No. 931).*

Manwell, Everett A. Health in high school science; the implementation of a philosophy of health teaching in high school science with a study of accompanying changes in pupils.*

Tuthill, Richard L. The economic geography of commercial air transportation; an introduction.

1947

Stollberg, Robert. Suggestions for teaching electronics.

Oakes, Mervin. Children's explanations of natural phenomena. (Contribution to Education No. 926).*

Walter, Raymond. A cooperative program for student teaching involving a private college and a city school system.

Weaver, Edward K. Meeting the needs of Negro science teachers in Alabama.

Wickware, Robert. Developing science education with regard for the regional community of eastern Connecticut.

1948

DeLaBarre, Cecil F. The development of a course of study in economic zoology for students of agiculture at the Virginia Polytechnic Institution.

Fraser, Thomas P. Science teachers objectives and attitudes toward using community resources; a study of fifteen Maryland negro secondary schools.

Lammers, Theresa. Some suggestions for the improvement of science education in the elementary schools of Massachusetts.

Stokes, Charles W. Initiating the improvement of instruction with special reference to science in the Mount Vernon secondary schools.

1949

Blisard, Thomas J. Developing physical science experiences at Madison College with special reference to housing.

Brandon, Donald G. American Negro migration from 1910-1947.

Brennan, Matthew J. A historical investigation of teaching concerned with the effects of alcohol upon the human body.

Fisher, John J. Science in general education with specific attention to the needs of premedical students.

Forbes, William C. The laboratory experience in science for general education.

Greenlee, Julian. A source book of science experiences for the use of teachers of young children.

Hubler, H. Clark. Science materials for elementary schools.

Lampkin, Richard. Variability in recognizing scientific inquiry; an analysis of high school science textbooks.*

Salem, Mohammed M. The training and attitudes of Egyptian biology teachers and American science teachers.*

Sarhan, El-Dermerdash. Interests and culture: a comparative study of interests, concerns, wishes, likes, dislikes, and happiest days of Egyptian and American children.*

St. Lawrence, Francis J. The use of teaching aids in biology textbooks.

Terwilliger, George L. A study of the community in biology classes at Northern Illinois State Teachers College.

Wilks, William T. Man and his natural environment: a sophomore science offering in the general education plan of the Troy, Alabama, State Teachers College.

Wilson, James Newton, Jr. A handbook on the political geography of the Orient.

1950

Fletcher, Ward. Resource-use related to science education in Florida; teaching materials for resource-use education in the area of natural land resources, to be used in the preservice education of teachers for Florida schools.

Hunter, W. Alexander. A handbook for student teachers of science with special implications for the teacher education program at Long Island University.

Huntley, Velma F. Helping college freshmen with their developmental tasks: a report of work done with girls enrolled in a course in anatomy and physiology.

Neal, Nathan A. A plan for a series of junior high school science textbooks.

Spielman, Harold S. Electronics for teachers; a resource unit in electronics for teachers of secondary school physical science.

Steele, William C. Some achievements in conservation in the United States; a progress report by states and regions.

Tannenbaum, Harold. Power and energy in our world.

Zimmer, George. A handbook for camera club advisors.

1951

Jacobson, Willard. Science education and the development of abilities to cope with problematic life situations.

Kiely, Lawrence. An experimental investigation of the effectiveness of student made drawings and photographs in microscopic work in pre-professional biology.

Knapman, Fred W. Science education and forest resource-use in northwestern Washington.

Kotb, Yusef. Science and science education in Egyptian society.*

Leader, William. The expressed science interests of students at the conclusion of a college science survey course and their relationship to achievement in the course.*

Mewha, Alan Parker. The Brandywine: A small region approach to conservation.*

Rice, Hugh S. Mathematical geography in American School textbocks.

Schwartz, Herbert. The world food problem; a teacher's source book of information and issues in the feeding of mankind.

Walter, Murray G. Developing an experimental program in science elective for grades 11 and 12 at the Garden City High School, Garden City, New York.

Zipper, Joseph. Development of an introductory biology course for Gannon College.

1952

Blick, David J. A comparison of three schedule patterns in the teaching of general chemistry.*

Griffin, Paul F. The contribution of Richard Elwood Dodge to educational geography.*

Hess, Fred D. Development of a course in the utilization of chemistry by marine engineers.

Merrill, William E. A proposal for science in the education of elementary teachers at Radford College.

Saveland, Robert N. A geography of Missouri for fourth and fifth grades.

Shawver, Benjamin T. College science for general education: planning for science teaching in a liberal arts college.

Shawver, Murl. Development of a plan for a two semester course in the biological science for Madison College, Harrisonburg, Virginia.

Subarsky, Zachariah. An experiment in reducing the informational dimension of prejudice.*

Turner, Byron J. Fuels: a guide and source book for the study of fuels and some problems arising from the utilization of fuels.

Warren, Percy H. The education of high school science teachers at Madison College.

Wells, John C. Manual of photography for teachers.

Winier, Leonard P. Biological science in the general education program at Iowa State Teachers College.

Yale, Francis G. A general education course in science for non-science majors at the University of Denver.

1953

Adegbite, Joseph. Science education and developmental tasks of Nigerian youth.

Agamia, Mohamed Abdel-Aziz. The petroleum industry in Iraq; its geosocial and geopolitical implications.

Blackwood, Paul E. An analysis of the statements of objectives, questions, and activities proposed by teachers for the study of two problem areas.*

Brown, Edward H. Health instruction in biology.

Franks, Cleveland. The organization, installation, implementation and administration of a course in physical science designed for general education.

Glassman, Seymour. High school students' ideas with respect to certain concepts related to chemical formulas and equations.*

Jensen, Jens Trygve. Nuclear energy, a resource unit for teachers of science.

Kaikow, Julius. The legal and administrative status of conservative education in the United States.

Korf, Frederick. Some changes in students during the first year of graduate work in science education.*

McGay, Culbert, Jr. Developing an orientation for the general education teacher with special competence in science.

Mikelson, Sylvan. Science in the core curriculum at the University School of the Ohio State University.

Prewitt, Charles. Relationships of science and democracy to education.

Sachs, Morris. A program of requirements and an instrument of appraisal of science facilities in elementary and junior high schools in New York City.

Silvan, James. The problem approach in science education, with special reference to insect control.

Whitford, Robert. Guide to physics literature.

Wright, Helen G. A geography of the USSR, a syllabus for college students.

1954

Bilheimer, Mary. Pragmatism and science education in American schools.

Brook, Hugh C. Directed studies in introductory college geography.

Chang, Yet-Oy. Soybean products as supplements to rice in Chinese diets with special reference to their protein and calcium content.

Gifford, Robert. A description of certain changes accompanying practice teaching and concomitant experiences.

Hassan, Ibrahim. The geography of the Suez Canal.

Kazeck, Melvin E. The geography of North Dakota.

Khalid, Abdulraham M. Science education in the Iraqi society.*

Lauer, Howard J. Developing problem-solving experiences in the survey course in physical science at the Willimantic State Teachers College.

Natunewicz, Henry. Geopolitics of the colony and state of Connecticut.

Navarra, John. The development of scientific concepts in childhood; a study of a young child's interaction with the physical phenomena of his environment.

Renner, George T. Geography of the state of Arizona.

Salmons, George B. Development of new curriculum materials based on the thermal conditioning of houses as an example of a life problem area.

Schenke, Lahron H. Information sources children use.

Taylor, Norman P. A suggested course of study in general science for urban schools in the Union of Burma.

1955

Arthur, E. Foster. Science and industrial arts; a source book for teachers of science and industrial arts.

Bernard, Brother Francis J. A study of the physiological, psychological and sociological factors in narcotics addiction and their implications for educational planning with social reference to the youth of New York.

1955

Chauvin, Robert S. Geography of Florida.

Hammond, Harry. Problems of the newly appointed and inexperienced science teachers of northern New Jersey.

Kiang, Ying. The geography of higher education in China.

Neivert, Sylvia. Identification of students with science potential

Pelham, William F. The analysis of science courses designed for general education.

Ramsaur, Robert T. Directed exercises in the political geography of Europe and the Near East.

Shute, Marlow F. Electric power technology and the physical sciences.

1956

Brand, Paul J. Geographic bases of land use occupancy in a micro-area: Lewisburg, Pennsylvania.

Cordova, Reuben. Leonia: a case study in planning a suburban community.

Denaburg, Jerome. The Cheasapeake Bay - A resource unit for biology teaching.

Gawley, Irwin H. Criteria for a general methods course in science education for New Jersey secondary school science teachers.

Hennings, George. The ecological basis of conservation.

Kerr, Elizabeth F. The role of the consultant in elementary science.

Mendenhall, Thomas. The growth of ideas leading to present day concepts of the atom.

Pallrand, George. The teaching of science as a process experience. A study of the developmental changes in students concepts of their responsibilities in determining classroom experiences.

Pregger, Fred T. Criteria for a special methods course in physical science education for New Jersey secondary school science teachers.

1956

Ravelli, Alfred J. A handbook for science fair advisors.

Richter, Marion. Drawing and learning in biology.

Russell, Harvey R. Patterns of cooperation between industry and education.

Sanguinetti, Carmen. Adapting science instruction in New York City Junior High Schools to the needs of Puerto Rican background pupils.

Sheckles, Mary E. A source book of experiences in science in childhood education.

Stempel, Edward. Current extemporaneous dosage forms. (Textbook for use in dispensing pharmacy courses).

Sutman, Frank X. Criteria for a special methods course in teaching of biological science for New Jersey secondary science teachers.

1957

Arnold, Frederic G. Suggestions for teaching selected materials in the area of the blood, lymph and tissue fluids.

Bell, Sylvester V. Improvement of biology instruction in small high schools in east Texas approached through the study of equipment and facilities.

Branley, Franklin. Astronomy resources for elementary school teachers.

Bryan, J. Ned. The development of physics teaching in the public secondary schools of the United States.*

Caruso, Mary L. An ocean geography for children.

Charney, Sol. A teacher's handbook of biological demonstrations for advanced science courses in the general education programs of Westchester secondary schools.

Eller, Frank W. Engineering education in the United States: a guide for use by elementary and secondary school teachers.

Gabler, Robert E. An analysis of a community study in central schools.

Grell, Einar F. Development of a functional senior course in the general education program of Mount Vernon High School.

Lah, Kihough H. Geography of Korea.

Notkin, Jerome J. Experiences to implement the course of study in elementary schools in New York City: grades K-6.

Sostman, Edna R. An evaluation of the methods, techniques and findings used during a six-year nutrition education program in a city school.

1958

Allen, Hugh, Jr. A study of the attitudes of certain high school seniors toward science and scientific careers.

Ashley, Tracy H., Jr. The development of a science program in the childhood education in the elementary school.

Bareham, John R. Earth science in the Baltimore area--opportunities for field work in geomorphology.

Brenowitz, Harry. Reorganization of the Adelphi College biology curriculum.

Carr, Albert B., Jr. Air pollution: an educational problem--a guide and source book for the study of air pollution.

Dean, Peter M. Problem solving techniques in teaching secondary school physics.

Garone, John E. Acquiring knowledge and attaining understanding of children's scientific concept development.

Goudey, Earl S. The sex education of 1500 twelve-year-old boys.

Grossman, Laurence J. A study of patterns which have characterized certain major scientific breakthroughs of the twentieth century.

Jones, Murray L. Illustrative materials for teaching certain geological concepts.

McInerney, George K. A history of the school garden association of New York - with emphasis upon its contributions to school activities which originate from school garden work.

Petrik, Eugene V. A study of patterns which have characterized certain major scientific breakthroughs of the twentieth century.

Post, Harold. Rats and mice - their relation to man - a source book for teachers.

Pugno, Lawrence. Science teaching and classroom research.

Rosengren, John H. A study of patterns which have characterized certain major scientific breakthroughs of the twentieth century.

Scidmore, Robert R. A study of patterns which have characterized certain major scientific breakthroughs of the twentieth century.

Shen, Samuel Yi-Wen. Guiding considerations of a functional science program for the Chinese elementary school.

Sparberg, Esther B. A study of patterns which have characterized certain major scientific breakthroughs of the twentieth century.

Stewart, Herbert H. A study of patterns which have characterized certain major scientific breakthroughs of the twentieth century.

Zapata Rivera, Lucila. Geography of the Commonwealth of Puerto Rico for secondary schools.

1959

Behnke, Frances L. Opinions of selected groups of high school science teachers and scientists on some issues related to science and science teaching.

Cox, Louis T. Developing guides to help kindergarten teachers meet with certain problems encountered in working with children in science in Lida Lee Tall School.

Fischler, Abraham S. Modern general science course.

Gard, Walter F. Using modern chemical theory in designing high school chemistry courses.

Hill, Mary M. The development of nutrition education and its implications for educational planning in elementary schools of the United States.

Kellerhouse, Stanley H. Microscope materials and techniques for secondary school biology - with special reference to the recommendations of the New York State Syllabus in biology.

Mecum, Ida M. Producing sixteen millimeter motion pictures for high school biology.

Pierce, Edward F. Modernized course of study in high school chemistry.

Stone, Dorothy F. Modern high school biology.

Trexler, Clarence R. A study of the relationship between the recorded and the observed conservation behavior of children in an urban classroom.

1959-1960

Chacko, Valikkodath V. Science and the community: a teacher's sourcebook related to the improvement of living conditions in rural India.

Daniels, Gert. Occupational Choices of Former National Science Fair.

Felton, Norborn M.L. An Investigation of the Use of Individual Science Projects in High School Physics Courses.

Lee, Roy. A Handbook of Microprojection for Biology Teachers.

Mills, Lester C. Problem-Solving Methods in Science Teaching.

Zafferoni, Joe. A Study of Pupil-Teacher Interaction in Planning Science Experiences.

1960-1961

Cicero, Donald R. Science Backgrounds and Subject-Matter Competency of Prospective Science Teachers.

Cullmann, Ralph E. A Sourcebook for the Beginning Chemistry Teacher.

Davis, Jerry B. Attitude Changes on Fallout and Race Associated with Special Instruction in Biology.

Feifer, Nathan. Relating the History of Science to Courses in Secondary School Science: a source book for the high school teacher of science.

Kantor, Joy Sandra. The Science Content of Preschool Children's Comments.

Lo Gerfo, John Joseph. A Program for the Education of Medical Technologists.

Ratau, Joseph T. An Experiment in Topic Selection in a Physical Science College Course.

Ulrich, Arthur Henry. The Development of an Advanced Course of Study in Biology.

1961-1962

Cooney, Mother Luke, R.S.H.M. A Handbook on Antibiotics for High School Teachers.

Crawford, George Mack. A Plan for the Improvement of Science Education in the County Elementary Schools of Maryland.

Cutler, Sister Mary Eugenia, R.D.C. American Patterns in General Chemistry Texts, 1800-1850.*

Feldman, Dorothy Gelber. The Genesis and Evolution of Virus-Like Particles Associated with Tumors in DBA Strain Mice.*

Gratz, Pauline. An Integrated Science Course for Nurses.

Jones, Elbert Ellery. A Physical Science Program.

Roos, Henry. Applications of Radio-Biology to the Secondary School Program.

Scott, Harold Merle. Teacher Education and Study of Community Problems in Maine: Suggestions for the Development of a General Education Course dealing with Community Problems in Maine with Special regard for Applications of Science and Technology.

Siddiq, Mohammed. Science Education in Afghanistan.

Trieger, Seymour. The Biological Environment: A Sourcebook for the Modern Elementary School Science Program of the Science Manpower Project.

1962-1963

Becker, Joseph Francis. Chemistry for Students of Health and Physical Education.

Erickson, Jay William. The Earth in Space: A Source Book for the Modern Elementary School Science Program of the Science Manpower Project.

McMillan, Annie May. A Study of the Food Habits of Families in Student Apartments at a University.

Vannoy, Joellene. A Plan for Promotion of Good Nutrition in Columbia through Mass Communication.

Wagner, Daniel. A Plan for a Proposed Course in Natural Science as an Eleventh or Twelfth Grade Elective in the New Rochelle, N.Y. schools.

1963-1964

Boenig, Robert. A Study of the Research Done in Science Education during the Years 1938-1947.

Emira, Ibrahim Bassyouni. Solar Energy: A Sourcebook for Science Teachers.

Focht, Elizabeth. The Relative Biological Effectiveness of 1.2 MEV Gamma Radiation and 200 KV X-Radiation for Cataract Induction.*

Honnen, James Francis, SR. The History of Chemistry Teaching in Catholic High Schools of the New York Archdiocese.*

Krowles, Chester Leon. The Essentials of Hi-Fi/Stereo Home Music Systems.

Montera, Anthony Pasqual. The Coagulation of Blood: A Source Book of Modern Knowledge for Biology Teachers.

Morholt, Evelyn. The Use of Chlorella to Teach Conceptual Schemes and Experimental Approaches in Biology: A Resource Unit to Illustrate the Use of an Organism as a Focus for the Development of Ideas Central to a Course of Study.

1964-1965

Cavanaugh, John R. A Teachers' Guide to the Use of Gibberellic Acid in Experiments with Plants.**

Dunfee, Emery S. A Demonstration Panel for Teaching Electricity and Electronics.

Giddings, Morsley G. Factors Related to Achievement in Junior High School Science in Disadvantaged Areas of New York City.

Jordan, Sladys E. The Development of the Foods and Nutrition Major Area of Study in Home Economics and the Current Status of Nutrition Teaching.

King, Robert N. The Earth on Which We Live: A Sourcebook for the Modern Elementary School Science Program of the Science Man-Power Project.

Laughlin, Alice M. Laboratory Experiments to Demonstrate in Vitro Uptake of Cobalt^{60} -- Labeled Vitamin B_{12} by Tissue Slices.**

Levine, Benjamin. Characteristics of Prospective Science Teachers Compared With Those of Prospective English Teachers.

Malkin, Samuel. The Role of the Elementary Science Consultant.

O'Neill, Catherine E. Laboratory Exercises to Demonstrate the Effects of Certain Hormones and Hormone Inhibitors on the Development of the Young Chick.**

Swift, J. Nathan. A Study of Research in Science Education: 1948 through 1952.**

Van Houten, William J. Laboratory and Demonstration Skills Needed to Teach Physics and Chemistry in the Secondary Schools: A Checklist and Suggested System for the Development of These Skills.

Wehrer, Robert. Healthful Living Through Science: A Sourcebook for the Modern Elementary School Science Program of the Science Manpower Project.

1965-1966

Croasdale, William. Machines, Materials, and Energy: A Source Book for the Modern Elementary School Science Program of the Science Manpower Project.

Goldberg, Lazer. The Science Vocabulary in the New York Times and in Political Materials in 1960.

Mirenda, Rose Mary. A Study of the Dietary Habits of Junior High School Students with Implications for Nutrition Education.

Schi[illegible]William. Electricity and Magnetism as Presented in American Secondary School Textbooks from 1800 to 1950.**

Strader, Herman L. A Program of Conservation Education: A Source Book for Teaching Conservation in Science Programs (With Special Reference to the Problems and Policies in the Area of Richmond, Virginia).

1966-1967

Hellman, Robert Alvin. A Proposed Secondary School Biology Syllabus for Uganda.

Hiack, Paul Stanley. Laboratory Experiments in College Physical Science for Prospective Elementary School Teachers.

Konicek, Richard Dean. Planning of Science Facilities for a Three-Year Comprehensive High School.

Leitman, Allan. Science for Deaf Children.

Paparello, Frank N. Junior High School Science: Guidelines for Curriculum Improvement.

Vinci, Thomas G. An Analysis of Elementary Science Handbooks and Their Relation to Science Programs in Three Districts in New York City.

1967-1968

Baker, Glenn Samuel. Space Science: A Monograph for a Course in a General Education Program.**

Fedai, Zia Mohamad. Energy: A Handbook for Science Teachers in Afghan Middle Schools.

Gershenowitz, Harry. A Textbook of Biological Science for the General Education Program.

Lennek, David. Open-Ended Experiments in Junior High School science: A Study of Their Effect on the Acquisition of Science Information, Laboratory Skills and Attitudes towards Science.

Stoltze, Herbert Julian. The Cytochemical Localization of B-Glycerophosphate Phosphatase in Ochromonas Malhamensis Grown Under Varying Nutritional Conditions.**

Wohl, Seth. An Approach to the Evaluation of Programmed Instructional Materials in Science for Local School Use.

1968-1969

Aron, Ivan M. Physics: A Detailed Guide to a New College Course for the Non-Scientist.

Benjamin, Theodore D. A Program for the Training of Teachers of Physics and Chemistry for Service in the Peace Corps in the Secondary Schools of English Speaking Africa.

Brovey, Daniel J. The Effectiveness of Advance Organizers in Acquiring Geological Knowledge in the Field.

Carol, Ruth E. Food Composition Tables and Automatic Analysis of Diet Histories.

Cravats, Monroe. A Study of the Value of Laboratory Exercises in a General Science Class of Low I.Q. Students in New York City.

Goodstein, Madeleine P. The Oxidation-Reduction Concept.

Icaza, Susana J. Programed Instruction Materials for Teaching Child Feeding Practices to Nursing Students in El Salvador.

Kiang, Min-Hsien Yang. Programmed Instruction in Nutrition for Baccalaureate Degree Nursing Students.

Kondo, Allan K. A Study of the Questioning Behavior of Teachers in the Science Curriculum Improvement Study Teaching the Unit on Material Objects.

Lurie, Arthur. The Development of a Modern Laboratory-Oriented One Semester Course of Study in Organic Chemistry at the High School Level.

Phelan, Elizabeth A. Research Studies Published in Science Education During 1953 through 1957.

Sugarbaker, John D. A Series of Measurement Activities with Common Materials for Junior High School Science.

Tannenbaum, Robert S. The Development of the Test of Science Processes.

Weisberg, Joseph S. The Use of Visual Advance Organizers for Learning Earth Science Concepts.

1969-1970

Fenderson, Carll Nathaniel. Maine Parks and Their Role in Conservation Education Programs.

Ghaznawi, Abdul Ghafoor. A Source Book for Chemistry Teachers in Afghan Senior High Schools.

Kaplan, William Allen. A Source Book for Teaching a High School Course in Materials Science and Technology.

Lawlor, Francis Xavier. The Effects of Verbal Reward on the Behavior of Children in the Primary Grades at a Cognitive Task Typical of the New Elementary Science Curricula.

Midili, John Arthur. An Analysis of the Factors Related to Dropouts of Technology Programs.

White, Philip. Attainment of Conservation of Mass and Weight Using Biologically Oriented Task Materials.

1970-1971

Flehinger, Lenore. Science Process Skill as a Predictor of Acquisition of Knowledge Among Preservice Teachers.

Liao, Thomas. The Use of Analog Computer Simulation for Learning Modeling Concepts and Skills.

Mack, James Patrick. The Occurrence of Vitamin A Compounds in Cellular Membranes.

Malone, Kathryn Eleanore. The Effectiveness of a Cybernetic Model as an Advance Organizer in Teaching Physiological Regulation.

Neujahr, James Lloyd. An Analysis of Teacher-Pupil Interactions When Instruction is Individualized.

Ogunyemi, Ebenezer Olanrewaju. A Study of the Effects of Different Sources of Verbalized Information on Performance at a Science-Related Cognitive Task.

Peterson, Clifford Harold. The Incorporation of the Basic Evolutionary Concepts of Charles Darwin in Selected American College Biology Programs in the Nineteen Century.

Trindade-Khristanand, Arnold Lucas. Structures in Science Teaching and Learning Outcomes.

1971-1972

Anastasia, Antoinette Marie. The Impact of Anatomy and Physiology on the Work of the Nurse.

Bartlett, Guilford Harrison, Jr. Relation of a Small Group Variable to Implementation of an Innovation in Elementary Science.

Essenfeld, Bernice Eleanor. Testing a Generalized Approach to Problems Relating Science and Society.

Mhlanga, Liberty. Ecology in a Biology Syllabus in Rhodesia.

Muzio, Joseph Nicholas. Alterations in the Normal Human Sleep EEG Pattern and Retention of Meaningful Verbal Material.

Oguntonade, Christopher Babefemi. An Analysis of Teachers' Verbal Explanation of Problems in High School Physics.

Rockhill, Ronald Henry. The Science and Science Education Backgrounds and Science Attitudes of Young Teachers in Elementary Schools Operated by Congregations of The Lutheran Church, Missouri Synod.

Sharp, William Legg, Jr. The Kinetic Structural Character of College Physics Lectures.

1972-1973

Berger, Toby Esther. Evaluation of an Environmental Science Laboratory Curriculum.**

Browne, Robert James. Pupil Perception of and Achievement in Secondary School Biology Lessons as Related to Lesson Kinetic Structure Analysis.

Carmody, Donald Joseph. The Distribution of Five Heavy Metals in the Sediment of the New York Bight.**

Dubowsky, Nathan. The Phagotrophic Specificity and Fate of Ingested Material in the Chrysomonad Flagellate, Ochomonas Malhamensis.

Garigliano, Leonard Joseph. The Relation of Wait-Time to Student Behaviors in Science Curriculum Improvement Study Lessons.

Muller, Werner Ernst, Jr. An Analysis of the Problem-Solving Process as a Learning Context and Its Relationship to Conceptualization in Elementary School Science.

Youngpeter, John Michael. Science Museums and Elementary Teacher Education: Organizing and Implementing Programs in Natural Science.

1973-1974

Butterworth, Thomas Michael. A Study of the Effect of Lesson Verbal Structure on Aspects of Student Affective Learning in Freshman College Biology.**

Ellis, Ronald Stanley Franklin. The Effects of Verbalization During Training on Performance at Criterion for Physical Science Students.

Lindquist, Pamela Adaline. Chloroplast Development in Cotyledons in Light Inhibited Seeds of Cucumis Sativus L.**

McKenna, Harold James. An Innovative Environmental Science Education Program for Secondary School Science Teachers.

Muehlke, Marjorie Sue. Kinetic Structure Analysis of College Biology Lectures.

1974-1975

Bennet, Patricia Lynn. A Comparison of Programs and Programming Times Between Secondary Students Employing Time-Sharing and Batch Processing Computers for Problem-Solving.

Bergman, Abby Barry. The Development and Implementation of a Perceptually Oriented Preschool Science Program.

Huegel, Douglas. An Exploratory Study of Certain Characteristics of Physics Teacher Lesson Presentations.

Lowell, Walter Edward. A Comparative Study of Abstract Learning in Mentally Retarded and Normal Subjects.

Moyle, John Samuel. Development and Evaluation of an Introductory Geology Course for the Purpose of Altering Student Attitudes Toward Conceptual Change.

Parish, Howard Irwin. A Resident Field Experience in Oceanography: Its Effect on the Attitude of Certain College Students.

Passow, Michael Joel. An Innovative Program for Teaching College Introductory Earth Science: An Exploratory Study.**

Sharma, Ramesh Chandra. Population and Resources in India - A Source Book for Teachers of Secondary Schools.

Sherman, Lloyd Russell. A Descriptive Analysis of On- and Off-Task Behavior of Some Students in a Tenth Grade Low-Teacher-Controlled Science Classroom.

True, Donald Smith. Problem Solving Instruction in Physics.**

1975-1976

Berger, Carole Louise. A Clinical Study of Immune Responses in Systemic Candidiasis Patients Cutaneous Candidiasis Patients, and Controls.**

Connor, James Vincent. A Humanistic Approach to Physical Science Development and Evaluation of a College Text for Nonscientists.

Lu, Phillip Kehwa. An Analytical Study of Various Kinetic Structural Patterns in Teaching Astronomy and Their Effects on Student Learning.*

Odunusi, Taiwo Olajide. The Performance of Nigerian Children in Science-Related Cognitive Tasks: Validation of Bloom's Taxonomy of Educational Objectives.

Pendaeli, John. The Analysis of a Chemistry Curriculum in Tanzania.

Werner, Neila Anne. A Case Study of Decision-Making in Elementary School Science Curriculum Improvement 1961-1974.

1976-1977

Eisenberg, Edmund. A Follow-up Study of Students who had Taken a Chemical Laboratory Study Skills Course.

Kaplan, David M. The Use of Nineteenth Century Landscape Paintings and Art-Related Projects in College Introductory Physical Geology Classes.**

Kittrell, Miriam. A Comparison of the Effects of Structure in Oral and Written Science Communications on Knowledge Recall by College Students of Varying Verbal Abilities.**

Kotsonis, Helen Hoch. The Effects of the Anesthetic Halothane on Chick Liver and Nerve Tissue.**

Lee, Mae Tuey. The Effects of Visuals and Communication Structure on Meaningful Knowledge Acquisition and Retention.

Lorenz, Karl M. The Creative Hypothesis and the Teaching of Science.

Moche, Dinah L. Experiment in Matching the Structure of Instructional Modules on Astrophysics to Cognitive Levels Among Urban Community College Students.*

Namuddu, Catherine Donate. Superstitions Among Ugandan Adolescents, Their Possible Scientific Explanation and Relation to the Curriculum.

Onyike, Innocent Ozurumba. Competencies Desirable for Secondary School Science Teachers in Nigeria with Implications for Teacher Education.

Silbert, Alvin Jay. A Study to Determine Some of the Effects of Two Educational Environments on High School Physics Students.

Taylor, William A. Influence of Teacher, Family, Media, and Avocational Factors on Career Interests of Black Ninth Grade Central City Students.